wegian motorship *Evita*, which met an east gale of force 8, lowest barometer 1,005.1 millibars (29.68 inches), in 25°01′ N., 128°28′ E.

A full report on the typhoons and depressions of the Far East from the Weather Bureau, Manila, P. I., follows below.

Two small disturbances occurred in the southeastern Pacific Tropics. In the first, on the 19th, the Norwegian motorship *Thor 1*, in 17°30′ N., 118°40′ W., experienced a wind no higher than force 7, from north-northeast, but there was a wind shift from northeast to south as the ship crossed the LOW, with lowest observed barometer of 1,000.7 millibars (29.55 inches).

In the second, on the 29th, the American steamer *Susan V. Luckenbach* encountered a strong east gale at noon, lowest barometer 1,009. 8 millibars (29.82 inches), close in off the Mexican coast about midway between Acapulco and Manzanillo. At evening observation of the 29th a radio message from the Italian steamer *Leme*, up the coast near Manzanillo, reported a north-northeast gale of force 9, barometer 1,000 millibars (29.53 inches), as the disturbance went inland.

Fog.—Fog had increased greatly over nearly all northern and upper middle waters of the North Pacific since the previous June. The fog belt in open ocean extended between about longitude 138° W. nearly to the Japanese coast. In west longitudes its southern limit was close to the 40th parallel, but in east longitudes the southern boundary was close to 35° N. Along the northern routes there was some 20 to 35 percent or more of fog between longitudes 150° W. and 145° E., with the most frequent occurrences as a rule about midway between the western Aleutians and central Japan. Along the American coast fog was abnormally frequent off California, where it was reported on 24 days. There were 8 days with fog off Lower California, and 11 off Washington, mostly in or at the entrance to the Strait of Juan de Fuca. Two days were observed with fog near the Mexican coast south of the Gulf of California.

TYPHOONS AND DEPRESSIONS OVER THE FAR EAST JULY 1939

By BERNARD F. DOUCETTE, S. J.

[Weather Bureau, Manila, P. I.]

Typhoon, July 7–12, 1939 (Northern).—This disturbance probably originated over the regions west-southwest of the Bonin Islands and first affected the Nansei (Loochoo) Islands during the afternoon of July 7, at that time being central about 400 miles east of Naha. The storm moved in a northwesterly direction, passing close to and southwest of Oshima, into the Eastern Sea. A change to the north over the Yellow Sea brought the center to the northern part of Chosen (Korea) where it recurved to the northeast and east as it moved toward the Pacific Ocean. The 2 p. m. observation, July 8, from Oshima showed a northeast wind, force 8 blowing, with a pressure value of 733.5 mm. (978.0 mb.). Naha, at the same time, had north-northwest winds, force 4, with 751.0 mm. (1,001.3 mb.) and Borodino Island reported south-southwest winds, force 4, and 752.7 mm. (1,003.5 mb.) for pressure.

Typhoon, July 7–13, 1939 (Southern).—This typhoon first appeared as a disturbance secondary to the typhoon described above and intensified when the primary storm had moved across the Eastern Sea. As a depression, central about 350 miles east-northeast of San Bernardino Strait at 6 a. m., July 7, it moved a short distance to the west-northwest, then northwest and inclined to the north. It intensified to typhoon strength when east of Balintang Channel and then moved north-northeast for a short distance. The morning weather map of July 10 had the center located about 300 miles east-southeast of Ishigakijima from which position it began a rapid northwesterly motion. The center crossed the Eastern Sea during July 11 and was entering the coast between Gutzlaff and Kamen during the morning of the next day. It passed close to and southwest of Shanghai during the late forenoon and early afternoon (July 12) and continued along a course almost parallel to the coast line. It disappeared over the continent the next day.

Pressure values and wind observations received from Shanghai on July 12 are as follows: At 6 a. m. pressure was 747.4 mm. (996.4 mb.) with northeast winds, force 7. At 2 p. m. the barometers recorded 744.4 mm. (992.4 mb.) with east-northeast winds, force 12. Newspapers printed dispatches in which it was stated that the winds reached velocities as high as 80 miles per hour and that at least six persons were killed in Shanghai because of this storm.

Typhoon, July 10–17, 1939.—Forming rather quickly about 120 miles west of northern Luzon, this typhoon moved northwest and changed its direction to the northeast after about one day's progress away from the Philippines. It moved across the western part of the Balintang and Bashi Channels to the ocean regions east of Formosa, where it inclined to the north, then northwest, thus crossing northern Formosa and the Formosa Channel and passing into the continent. It disappeared about 500 miles away from the coast line after moving northwest and west.

The afternoon situation west of northern Luzon, July 10, indicated the formation of a new disturbance. The S. S. *Mausang*, en route to Hong Kong, reported from various positions about 180 miles west of Baguio pressure values between 749 and 748 mm. (998.6 and 997.3 mb.), with winds of force 6 from the north-northwest and west. The S. S. *Tjikarang*, at 2 p. m. Manila time, had winds of force 5 from the north-northwest with pressure at 749.0 mm. (998.6 mb.), the ship's position being latitude 18.7° N, longitude 116.6 E. Vigan and Laoag, situated along the western coast of Luzon, had southwest and south winds, force 3, with pressure at 749.5 mm. (999.3 mb.).

It seems that the north quadrant winds due to the typhoon preceding this storm interacted with the strong southwesterly current to form this typhoon. The pilot balloon observation at Aparri on the afternoon of the 10th had northwest winds at some levels which could be caused by the typhoon center 550 miles northeast of the station.

Typhoon, July 15–20, 1939.—As a low-pressure area, then depression, this disturbance moved in a northwesterly direction from the ocean regions about halfway between the Philippines and the Mariana Islands. The morning of the 18th found the storm intense enough to be classified as a typhoon, central about 400 miles northeast of Aparri, Cagayan Pr. For a few hours it moved north-northeast, then changed to the northwest when directly east of southern Formosa. The storm entered the continent July 20 about 120 miles south of Shanghai and disappeared the next day.

The morning observations, July 19, from Ishigakijima, Nansei Islands, showed a pressure of 748.0 mm. (997.3 mb.) with calm. At Naha, Nansei Islands, southeast winds, force 3, were reported, with pressure at 749.5 mm. (999.3 mb.).

Typhoon, July 20–27, 1939.—Similar to the typhoon just described, a depression formed over the ocean regions between the Philippines and the Mariana Islands and then moved northwest to a position about 250 miles east-by-north of Basco, Batanes Islands, where it was stationary

for 2 days. It intensified into a typhoon and moved rapidly north-northeast to the regions about 100 miles northeast of Oshima, Nansei Islands, where it sharply changed to the west. It almost crossed the Eastern Sea, July 26 and 27, but disappeared before it reached the coast.

On July 24 the morning observations at Naha and Borodino, Nansei Islands, were the lowest pressures reported during the progress of this storm. Naha had 749.5 mm. (999.3 mb.) with northeast winds, force 3. Borodino reported 751.3 mm. (1,001.7 mb.) with south winds, force 4. As the typhoon changed its course to the west on the morning of the 25th, Oshima recorded a pressure value of 751.0 mm. (1,001.3 mb.), with northwest winds of force 1.

Typhoon, July 22–25, 1939 (Pacific Ocean).—A well-developed typhoon appeared about 700 miles east of Formosa, moved rapidly north, then northwest, passing close-to and south of Kiu-siu Island, Japan. It crossed the northern part of the Eastern Sea and then traversed the Yellow Sea, disappearing over the continent west of Shantung Peninsula.

Observations made at Borodino Island and other stations show the strength of this storm. At 6 a. m., July 22, Borodino pressure was 748.6 mm. (998.0 mb.), with winds from the north-northeast, force 4. The afternoon pressure (2 p. m.) was 747.0 mm. (995.9 mb.), with winds of force 3 from the north-northeast. On the 23d, as the center passed from the Pacific Ocean into the Eastern Sea, Oshima, Nansei Islands, and Kagoshima and Nagasaki, both on Kiu-siu Island, had pressure values between 748.0 mm. and 750.0 mm. (997.3 and 1,000.0 mb.), with winds not exceeding force 4.

Typhoon, July 22–24, 1939 (Formosa Channel).—During these days, there was evidence from ships that a small but active center existed over the southern part of the Formosa Channel. This center formed close-to and west of southern Formosa, moved northwest about 30 miles, then northeast about 60 miles, after which no trace of it could be found.

The U. S. S. *Gold Star*, en route Hong Kong to Shanghai and the U. S. S. *Henderson*, en route Shanghai to Hong Kong, passed each other along the coast about the middle of the Formosa Channel. Both ships reported winds from the northeast quadrant, force 5 to 7, with pressure values between 746.3 mm. and 748.0 mm. (994.9 and 997.3 mb.).

It must be kept in mind that no weather observations were received from Formosa during this whole period and that the positions and directions of these disturbances, when near or over Formosa, may be subject to correction when information from Formosa during these days becomes available.

The upper winds, as received by radio broadcasts mostly, show the gradual movement of the southwesterly current toward the Pacific Ocean, its extent, and its strength. Beginning July 3, this current, which had been in existence over Thailand (Siam) and Sumatra during June, advanced eastward. It passed Menado on July 5, and reached the regions east of Yap the same day. Not until July 21, however, did Guam have the southwest winds. Over the Philippines, the southwest winds passed Zamboanga July 3, Cebu on July 5, and Manila on July 7 and 8. A day later Aparri was under its influence. Then, for the rest of the month, the whole Archipelago was under the influence of this powerful current, the velocities often reaching 80 k. p. h. Zamboanga, however, escaped the strength of this current of air, the directions being from the southwest quadrant, but much weaker than the northern stations, and with east quadrant winds appearing once in a while aloft. The forecasting value of the pilots consisted in the persistence of the high velocities. A disturbance would be moving away from the Archipelago, but the velocities aloft would maintain their high values, which was a good indication that a new disturbance was forming. Hong Kong and the stations of northern Indochina did not feel the strength of the southwest current of air until about July 18, after which the velocities reported compared with those of the Philippines. The only pilots from northern stations were those from the U. S. S. *Augusta* and the U. S. S. *Blackhawk*, the former ship being first at Tsingtao and then at Shanghai, the latter ship remaining at Cheefoo during the whole period. The U. S. S. *Augusta* reported southeast, south, and southwest quadrant winds mostly, with one ascent at Shanghai showing northeast quadrant winds below and southeast quadrant winds aloft. Velocities were never above 50 k. p. h. The U. S. S. *Henderson* was en route from Shanghai to Hong Kong July 22 and 23 and reported northeast quadrant winds from 20 to 60 k. p. h. from positions in the Eastern Sea along the China coast line north of Formosa while the typhoon of July 22 to 24 was in existence over the southern part of the Formosa Channel. In conclusion, the data available indicate that the southwest current of air was the most active sector of the typhoon circulation and its extent was from Hong Kong and northern Indochina southward to southern Sumatra and other islands having the same latitude, Zamboanga and other stations to the south, however, being without the strong velocities of the northern stations. No information west of Thailand (Siam) is available at the present writing.

The Manila newspapers of July 25 reported that two persons were killed and considerable damage to public and private property resulted from the heavy rains caused by the above series of typhoons.

Typhoon, July 25–August 6, 1939.—From a low pressure area over the Pacific, first manifesting itself on the afternoon of July 25, and moving northwesterly, a typhoon developed July 27, being central about 450 miles east-northeast of Aparri. Moving northwesterly about 180 miles, then westerly about 250 miles, it inclined northward, thus approaching the coast line of northern Formosa. It then executed a counterclockwise loop southward over Formosa, as well as can be determined from observations available, and began to move along an easterly course, being located about 250 miles from central Formosa on the morning of August 1. It then moved rapidly east-northeast or northeast to a position about 200 miles east of Oshima, Nansei (Loochoo) Islands where it was stationary August 3 and 4. It then moved about 100 miles to the northwest and suddenly changed to the east, as a weak disturbance which soon disappeared over the ocean regions between the Bonins and Japan.

Pressure values reported from Ishigakijima, Nansei (Loochoo) Islands, on July 30 and 31 were between 748 and 749 mm. (997.3 and 998.6 mb.) with northeast quadrant winds, force 3 and 2. At the same time, pressure values over the whole Philippine Archipelago fell suddenly, the greatest fall being at Basco, where 746.7 mm. (995.5 mb.) was the lowest value reported for the weather maps (July 31, 2 p. m.) with west-southwest winds force 5. Because of this sudden fall of pressure, so far-reaching in effect, it is thought that the typhoon center made a loop to the south. Besides, at Aparri, the upper winds of the afternoon ascents of July 29 and 30 reached values of 110 k. p. h., the directions being southwest and west-southwest.

Typhoon, July 28–August 8, 1939.—Before July 28, a low pressure area existed over the ocean regions adjacent to the northern Mariana Islands as a disturbance which

seemed to have formed southeast of that locality. It was moving northwest and developed into a typhoon on the morning of July 28, central about 250 miles south or south-southeast of the Bonins. This typhoon moved westerly for about 700 miles and then made a short but rather sharp inclination to the north, being located near latitude 24° N., longitude 131° E., on the morning of July 31. Then it began its rapid movement toward the east-northeast, passing near or over the Bonins early in the morning of August 2. From the few observations available, it seems that it was stationary about 400 miles east-northeast of the Bonins on August 3 and 4, after which it moved north, then northwest, the latter course directing the center toward Japan. It crossed central Japan on August 6, and then recurved to the northeast over the Sea of Japan. An inclination to the east caused the center, now weakening, to cross Hokkaido Island on its way to the Pacific Ocean.

Pressure at Borodino Island, July 31, 6 a. m., was 745.6 mm. (994.1 mb.) with winds of force 4 from the northeast. At the Bonins, August 2, 6 a. m., a pressure value of 743.0 mm. (990.6 mb.) was reported, the winds being north, force 5. The S. S. *Manoeran*, August 4, added to the afternoon weather telegram the following remark: "In center of typhoon. 0530 G. M. T. 30° N., 149° E., pressure 720 mm., moving north" (959.9 mb.). At 0600 G. M. T., the weather observation from this ship, latitude 30.0° N., longitude 149.1° E., showed pressure at 720.5 mm. (28.366 in.) with west-northwest winds, force 10.

The upper winds over the Philippines remained approximately the same as those predominating during the typhoons of the earlier days of the month. Heavy rains caused the death of three persons in the Philippines during the latter part of the month.

At Vigan, Ilocos Sur, during the forenoon hours of July 29, a strong whirlwind, about 90 meters in diameter, formed near the sea shore and moved inland about a distance of 4 kilometers. It was mild when in process of formation, but became violent when passing over the center of Vigan, where it ripped up roofs and uprooted trees. The whirlwind passed close to the building where the meteorological instruments were installed. The anemograph registered 40 m. p. h. as its highest velocity and the barometer fell about 4 mm. and then ascended to its former value as the storm went by. There was a counterclockwise rotation, with strong upward winds. Considerable destruction to substantial buildings resulted, and one person was injured to such an extent that death resulted a few days later.